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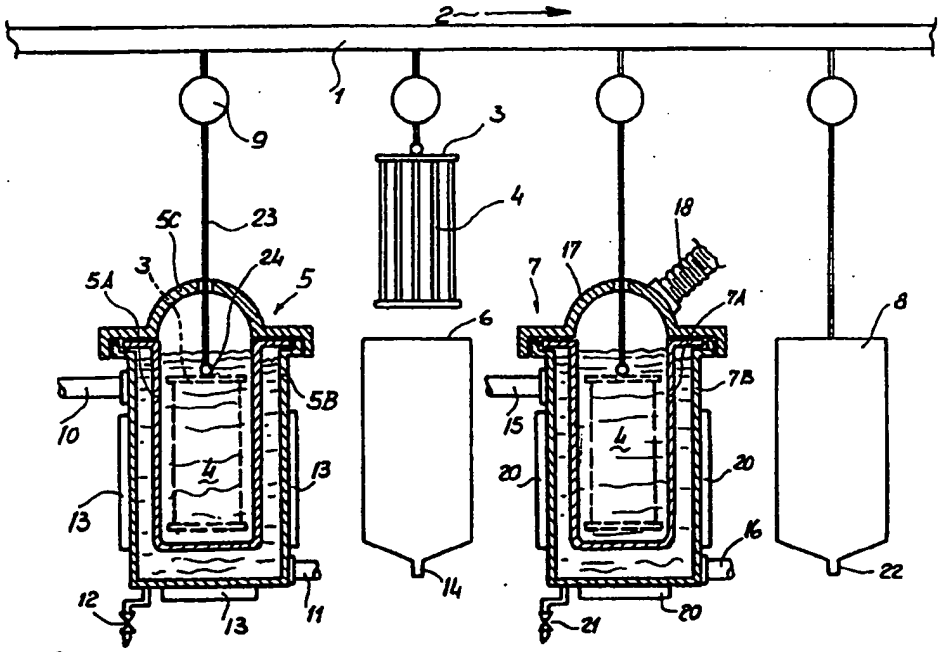
(54) Total decontamination process for radioactive metal material.

(57) Total decontamination process for radioactive metal material, particularly for the tubes (4) of the nuclear power station tube nests, which process first uses together ultrasounds of controlled frequency (13) and a washing in a first water tank of controlled temperature (5), then only a washing in a second water tank (6) and then together ultrasounds of controlled frequency (20) and a washing in a third tank (7) containing strong mineral acids under controlled temperature.



EP 0 418 722 A1

TOTAL DECONTAMINATION PROCESS FOR RADIACTIVE METAL MATERIAL.

This prevent invention relates to a total decontamination process for metal radioactive material, in particular to radiactive metal material presenting big surfaces and recesses, like the tubes for the tube nests in the heat exchangers of a nuclear power station.

On life termination of a nuclear power station there is the problem to dismantle the radioactive metal parts and conveniently treat such parts in order to reduce the amount of material to be delivered to the open storages for radioactive materials.

According to the prior art, radioactive metal surfaces are decontaminated by means of chemical solutions of different kinds, electrolytic precesses, mechanical means, pressurized water jets and ultrasounds.

The drawback in the known processes resides in the unsatisfactory effectiveness for material presenting big surfaces and recesses, as it particularly happens in said tubes, so that there is always some residual radiactivity preventing from completing decontamination, and consequently, reducing the waste amounts to be delivered to said storages.

The process according to this present invention obviates said drawback.

This invented process first uses together ultrasounds and washing in a water bath and then uses together ultrasounds and washing in a strong mineral acids bath according to steps that, as known, lead to a synergic effect in the action of removing the contaminated layer from the surface of the radioactive metal material. In a new way and as characterized in the appended claims, this invented process defines a whole of conditions which allow the maximum decontaminating effect and are set substantially through the steps of: subjecting the radioactive material dipped in a first bath of controlled temperature water to a beam of continuous ultrasounds of controlled frequency; removing said material from said first bath and washing it in fresh water; subjecting said material to a second bath in a water solution of strong mineral acids under controlled temperature and subjecting said material in said second bath to a continuous ultrasound flow of controlled frequency.

The length of last said step varies according to the strength of the acid bath and decreases as the material dissolves; preferably, a sequence of immersions is carried out; at the end of each immersion, the material is removed from the bath in order to carry out a preliminary visual examination and the material presenting metallic gloss on its inner and outer surfaces is removed from the bath and delivered to radiometric checking. The solution is considered exhaust as the iron concentration is higher than 30 g/l (the iron concentration may be determined, for instance, by a spectrophotometer).

It will be realized that this invented process is particularly suitable to decontaminate tubes of the tube nests of the heat exchangers in the nuclear power stations and more particularly tube nests of the feeding regenerators in boiling water power stations.

The paramount advantage of this invented process resides in that the radiactive material is decontaminated over those standars that are usually accepted for releasing non-inspected or non-conditioned material and in that the waste to be delivered to said storages, consisting in the residuals from the decontaminating solutions, are much reduced in amount.

The invention is described in detail herebelow with reference to the figure which is a side view of a plant for carrying out the invention.

A monorail 1 moves in the direction of arrow 2 a plurality of hung and conveniently spaced cages 3, each containing a set 4 of one hundred tubes each being one meter long and set in the cage vertically; each set of tubes 4 in its cage is dipped sequentially in the tanks 5, 6, 7 and 8 by hoists 9, as detailed hereinbelow.

First tank 5 comprises an inner tank 5A and an outer tank 5B, both covered by a common cover 5C; inner tank 5A contains washing water for the tubes and in outer tank 5B is circulated a diathermic solution to keep at 55° C the temperature of the washing water in tank 5A. Said solution is supplied from a suitable conventional first boiler, not shown in the figure, that gives it the required temperature; a pump, not shown in the figure, supplies the solution to the tank through inlet duct 10 and the solution comes back to said boiler through outlet duct 11. Bottom exhaust means 12 allows to completely empty tank 5B, if necessary. An assembly of ultrasound emitting piezoelectric transducers 13, of 20 kHz frequency, is applied to the outer of side and bottom walls of tank 5B, said transducers being of such specification and number as to maintain in the inner tank 5A an homogeneous power density of 25 Watt per liter (W/l). The tank 5A inner sizes are 50 x 50 x 150 cm (150 cm height). The tube set 4 is left in the washing water during a time period of 2 hours.

Second tank 6 recycles a steam of fresh water from an outer source through inlet and outlet ducts, not shown in the figure, to energetically wash the tubes of a set of tubes 4 dipped in said tank together with its cage 3, after removal from tank 5. Tank 6 too comprises bottom exhaust means 14.

Third tank 7 comprises an inner tank 7A and

an outer tank 7B; the inner tank contains a solution from 3,0% to 4,0% of HF (hydrofluoric acid) and from 5,0% to 6,0% of HNO_3 (nitric acid) (% in volume), in water maintained at the temperature of 70° C by a diathermic solution which is supplied to tank 7B through inlet duct 15 and removed through inlet 16, similarly to the explaination referred to tank 5. Tank 7A is covered by cover 17 provided with an opening connected with an intake tube 18 to remove acid vapours emitted from the solution in the tank. Tank 7B is provided with a bottom exhaust means 21. An assembly of ultrasound emitting piezoelectric tranducers 20 is applied to the outer of side and bottom walls of tank 7B, similarly to the description referred to tank 5.

Fourth tank 8 is similar to tank 6 described above. The decontaminated tubes are washed in running water energetically in said fourth tank to release in the water the residual radioactive material particles detached from the tube outer and, in particular, inner surface. This tank too is provided with a bottom exhaust means 22.

A cable 23 is associated to the holst 9 supporting a cage 3 and a clamp 24 at the bottom of said cable holds said cage.

It will be realized that tanks and other parts which may be in contact with radioactive materials and with acids are made of suitable materials.

Claims

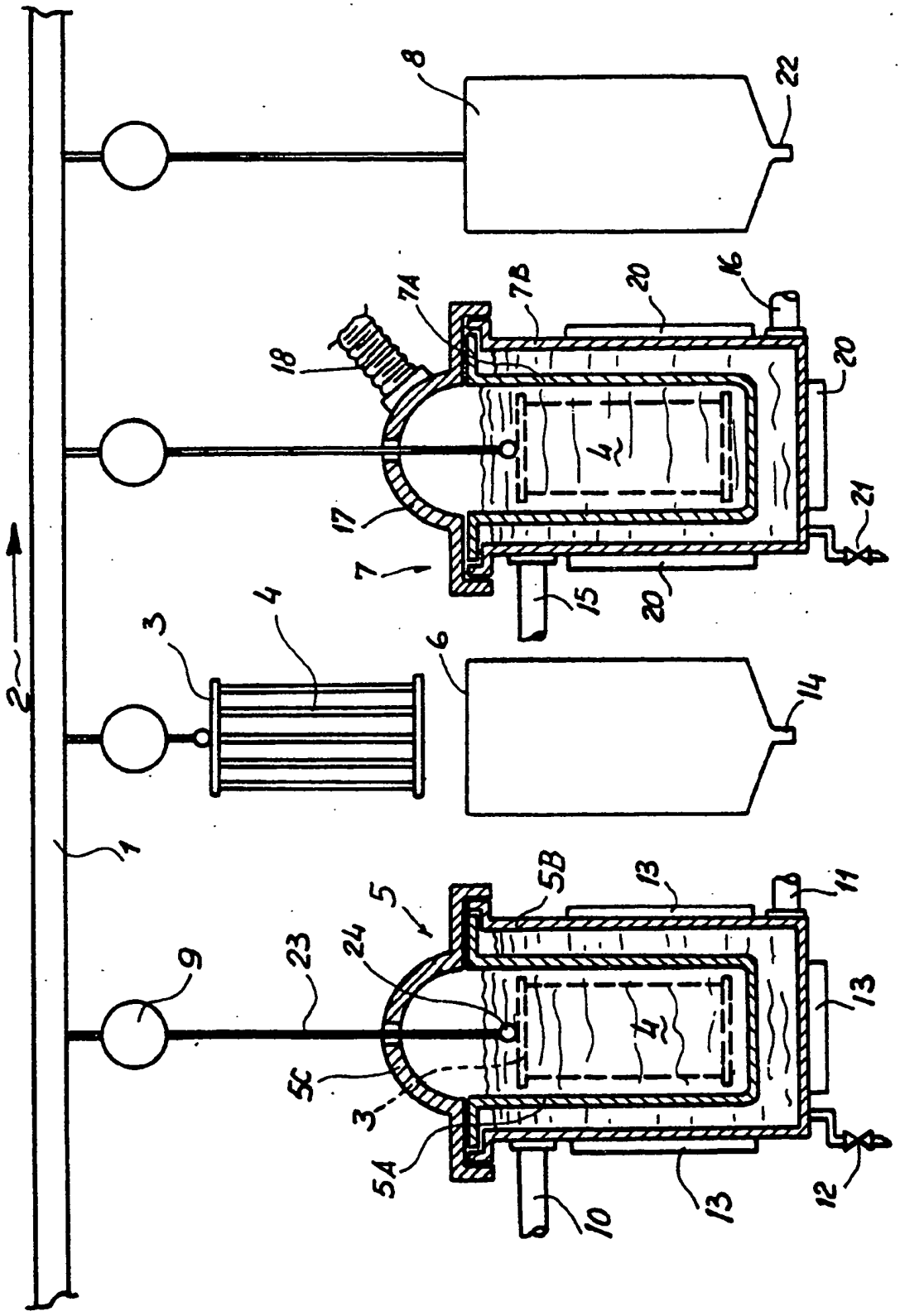
1. A total decontamination process for radioactive metal material comprising a water washing of said material under continuous ultrasound flow characterized in that said material is also washed in a solution of strong mineral acids under controlled temperature, simultaneously subjected to an ultrasounds flow of controlled frequency and power and then to a fresh water washing.

2. A total decontamination process according to claim 1 characterized in that the subsequent steps are comprised of: a) subjecting said material to a first water washing bath at a temperature ranging from 50° to 60° C and to a continuous ultrasounds beam of frequency ranging from 20 kHz to 22 kHz and at least 15 W/l power; b) applying above step a) during a time period ranging from 50 to 70 minutes and then removing said material from said first bath; c) subjecting said material removed from said first bath to a second bath in a water solution of 3,0% to 4,0% HF and 5,0% to 6,0% HNO_3 at temperature ranging from 60° C to 70° C simultaneously subjecting said material in said solution to a continuous ultrasounds beam of frequency ranging from 20 kHz to 22 kHz and at least 15 W/l.

3. A process according to claim 2 characterized in that above step c) is applied during a time period ranging from 75 to 120 minutes.

4. A process according to claim 2 characterized in that the ratio between the surface of said material the the volume of said HF and HNO_3 solution in said second bath is 3 dm^2/l as a maximum.

5. A process according to claim 2 characterized in that between above steps b) and c) said material is dipped in a fresh water tank to be washed.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European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 11 7571

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	PATENT OFFICE OF JAPAN, FILE SUPPLIER JAPS, Tokyo, JP; & JP-A-1 233 398 (TOSHIBA) * Whole abstract *	1,4,5	G 21 F 9/00
Y	FR-A-2 590 716 (EDF) * Claims 1,5,8 *	1,4,5	
A	FR-A-2 586 322 (FRAMATOME) * Claims 1,3,6 *	1,5	
A	EP-A-0 106 959 (BBR)		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

G 21 F

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	26 November 90	NICOLAS H.J.F.

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
Y: particularly relevant if combined with another document of the same catagory
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention

E: earlier patent document, but published on, or after the filing date
D: document cited in the application
L: document cited for other reasons

&: member of the same patent family, corresponding document

DERWENT-ACC-NO: 1995-209692

DERWENT-WEEK: 199528

TITLE: Spacer for nuclear fuel assembly - comprises two circular steel sheets welded to each other to form ring, giving simplified structure due to reduced number of parts constituting spacer

PATENT-ASSIGNEE: HITACHI LTD[HITA]

PRIORITY-DATA: 1993JP-0264548 (October 22, 1993)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
JP 07120578 A	May 12, 1995	N/A	004	G21C 003/344

APPLICATION-DATA:

PUB-NO	APPL-DESCRIPTOR	APPL-NO	APPL-DATE
JP 07120578A	N/A	1993JP-0264548	October 22, 1993

INT-CL (IPC): G21C003/344

ABSTRACTED-PUB-NO: JP 07120578A

BASIC-ABSTRACT:

In a nuclear fuel assembly in which fuel rods are supported by top and bottom tie plates and by several spacers distributed evenly along the fuel rod bundle, the spacer is made up of two circularly formed steel sheets e.g. (10,10') which are welded to each other to form a ring.

USE - Used for an advanced thermal reactor.